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# Attention Deficit Hyperactivity Disorder (ADHD) and Writing Learning Disabilities

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## 1. Introduction

In this chapter, a brief of three studies relating attention deficit and hyperactivity disorder (ADHD) and writing Learning Disabilities (LD) is presented, all of them following a research line. First, we carried out an experimental study on attention and writing with normally developing students, investigating the effects of the use of a graphic organizer and a time interval register processes in writing composition. Second, we selected four samples of students, one group of students with ADHD and LD, one with ADHD without LD. The third group comprised students with LD, and the last group was made up of normally achieving students. Those groups were matched for age and educational level, and we evaluated variables of attention, working memory (first comparative study), and also the processes and the product of writing composition including the orchestration (second comparative study).

We reviewed the previous empirical studies that served as background work. From this review we found that there are only a few published research studies that analyze the overlap of the presence of ADHD and LD in writing, as well as the need to study the relationship between attention and writing in normally achieving students. Besides, it was found a paucity of knowledge regarding the relationship between ADHD and writing LD. It is also pertinent to briefly conceptualize, ADHD and its various presentations; LD in writing; and the existing studies about the overlap of ADHD and LD in writing.

## 2. ADHD and writing

The problems of the ADHD are very common; between 3 and 6 per cent of all children in school age suffer from it (American Psychiatric Association [APA], 2002) and the problems continue for these children as they grow up in about 40 per cent of the cases, as the revision of Nolan, Volpe, Gadow, & Sprafkin (1999) points out. Other researches even increase this number stating the percentage of children suffering from ADHD in school age to up to 5 to 10 per cent (Scahill & Schwab-Stone, 2000). With these facts and facing the education procedure, we have to keep in mind that in our classrooms there is at least one child that suffers from ADHD (DeShazo, Lyman, & Grofer, 2002). These research studies show us the need of considering this kind of problems, approaching diagnosis and intervention about

ADHD. We also need to provide them strategies that can help in their day-to-day life since there is still no total solution to the problem.

On the other hand, another reason for this chapter is the link this diagnosis presents with other problems or difficulties, as supported by a number of studies (comorbidity with anxiety disorders, bipolar disorder, ODD, etc.). In these studies it is stated that the overlap of the ADHD might be up to 80 per cent with two or three or even more developmental disorders (Kaplan, Dewey, Crawford, & Wilson, 2001). Considering the high prevalence and the large overlap, and that the people suffering from ADHD shows a lack of control of their impulses, it is probable that this will be shown in the written composition.

It is known that writing requires thinking about the aim, the readers, the rhetorical elements, outline, details, complexity, result, coherence, etc. (Alamargot & Chanquoy, 2001; García & de Caso, 2002; Kellogg, 1994; Munro & Howes, 1998; Torrance & Galbraith, 2006; Wong, 2000). Furthermore, the written composition is a complex process that includes having a lot of information in the long term memory and keeps that in mind during the whole process of work, at the same time as one plan, create and revise the ideas. All these activities require a high standard on the attention system and on the working memory, which gives as a result that children suffering from ADHD commit syntactic errors, coherence errors, and that they use a simple structure and a very basic vocabulary (Gregg, Coleman, Stennett, & Davis, 2002).

On the other hand, the short time of planning and supervision of the work produced by students with ADHD, using processes of writing that are very fixed and basic, also influences the final result in a negative way with the creation of short stories in which some of the most fundamental components are omitted and with low coherence. In this point double theory comes, the first one is if the difficulties in writing are secondary problems of the ADHD or are problems related with, and the second one is about the way oneself could interfere and contribute to solve these difficulties.

Considering it in this way, the effective writer chooses, adopts or invents strategies that will improve his aims (Buttler, Elashuk & Poole, 2000; de la Paz, 1999, 2001), that is, in an auto-settled way (Graham & Harris, 2000), which implies an efficient use of the cognitive ways, such as the reflexive. The intervention focused on improving the strategy of the reflexive process is important and interesting, as well as the cases of overlapping between the ADHD and problems with written composition.

We have to consider the fact that the mental effort and the attention resources are limited when written assignments are being carried out (Alamargot & Chanquoy, 2001). This implies that several processes have to be considered at the same time (the search for a letter, the theme, the ideas, the readers, or the general plan of the written composition) and in an auto-settled and developing way (García & Fidalgo, 2003); which gives the result that if someone has attention difficulties this would be reflected in the written composition, and also in the complex process of writing (Gregg et al., 2002).

These research studies show us the need and relevancy of going deeper into the research about the overlap between the ADHD and the learning difficulties, since very few researchers have tried to identify the relationship between different frequent subtypes amongst students suffering from ADHD and LD, that is, extending current studies (Gregg et

al., 2002). The research about the overlap seems very relevant if we look at it from the developing and intervention point of view. Concentrating on the context and the various components and considering the main problem the lack of ability of self-regulation and control of impulses (Barkley 1997a, 1997b, 1998, 2001; Miranda & Presentación, 2000) and do that in relation with writing. For example, according to the theory of Barkley (1997a; 1997b), the problem that people suffering from ADHD presents is a lack of behavioural inhibition which affects four important executive functions (working memory; self-regulation of affection/motivation/activation; language internalization; and reconstitution); all of which affect the force/fluency/syntax control of the behaviour. It is predictable that we can achieve some understanding about the problem that these people suffer from by doing a research on written composition, but we also need more specific and in-depth research. Furthermore, there is a lack of research which considers the educational point of view of the overlap between ADHD and the written composition, and here is where this research line is important and relevant.

It is to be stressed, - and it might seem shocking - that with these premises the research about the ADHD and writing have not been done with nearly the depth that these facts imply. In the same way, it is one of the important limitations we have found in the making of this work; the very few previous researches to study, and the lack of previous theory. This fact composes the biggest difficulty in the research that we are going to present on the coming pages, but we have also faced the complexity of carrying out a study which covers a variety of complex structures, such as ADHD and writing.

Finally, and briefly previously mentioned, it seems necessary to know in depth how the problems of ADHD affect written composition. It also seems necessary to answer the question or assumption of a link or/and an overlap, of the learning difficulties in written composition and how ADHD is affecting other LD such as in mathematics or in reading (Miranda, Meliá-de Alba, Marco-Taverner, Roselló, & Mulas, 2006), specifically when it comes to learning disabilities in mathematics LDM. Fletcher (2005) considers that the combination of LDM and ADHD seems to be linked; a child with these problems is affected by the typical learning difficulties in both diagnoses. The outline of the cognitive test results of children suffering from control group and ADHD were similar, but with a different outline both within group of LDM as well as between ADHD and LDM.

## **2.1 Prevalence data and epidemiology**

Presently, are necessary analyzing theoretical models of writing with a view to considering possible connections between writing and ADHD. This connection is not proposed directly by the theoretical models, but given the types of components they include we can make some inferences that will help us to better understand the relationship of overlap or comorbidity between ADHD and LD in writing, for example (Rodríguez et al., 2010). We have seen that the main theories on writing and the main theories on ADHD include aspects that are related to each other. And throughout these theories we can support a common base to explain the relation between the two problems. With this theoretical approaching we have answered another of the theoretical problems, which was to analyse the link between different theories on written composition and theories on ADHD, and also with recent trends of diagnosis and intervention in this disorder.

Secondly, this research line has also opened a way for a future link between the theories on ADHD and the theories on written composition, since we have seen that both models fit with each other in several ways, above all when it comes to the working memory and the executive function (Rodríguez et al., 2010). We can also see that the expected growing importance of the working memory and the attention, within what is called *sluggish cognitive tempo* as a difference to the inattentive subtype in ADHD, make these relations increase since basically all theories support on the working memory, such as the ones of Kellogg or Hayes. They consider this subtype to be the most probable of all three subtypes to have learning disabilities in writing (Rodríguez et al., 2011a; Seidman, Biederman, Monuteaux, Valera, & Doyle, 2005).

As we have known throughout the theoretical support of this line, the whole scientific world agrees on that the problems of ADHD and LD on writing are frequently related. We have also seen this in the analysis of the theories on this type, which are also backed up by empiric studies (Holowenko, & Pashute, 2000; Kadesjö & Gillbert, 2001; Mayes, Calhoun, & Crowell, 2000).

On the one hand the link between ADHD and writing on a theoretical level and on the other on a field research level, contrast the influence of ADHD in school, being one of the most important disorders causing LD in writing. We can also see that these theories are not backed up by scientific empiric studies in this aspect (Rodríguez et al., 2011b).

In this sense we had the aim to find out about the current state of investigation and empiric studies on writing and ADHD. When investigating this it has been found that the scientific research in this aspect – the link between ADHD and writing – was generally limited to mechanical aspects of this ability, simple aspects such as the graph. The few times it is done on a deeper level the samples are not broad enough, or they are based on studies epidemiological or a questionnaire to define the child suffering from ADHD. One could say that generally, the underlying processes to ADHD are neither analysed nor profoundly studied, but studied in a wide, general way and not deeply (Ambalavanan & Loteen, 2005).

An important aspect to consider, and an implication in this chapter, has to do with something very important when this research began, and is based on the aim of analysing new tendencies in the diagnosis and intervention on ADHD, and to put this in relation to problems added to this disorder, specifically LD in writing.

In first place, the sample that we have used in the greater part of our empiric study, consists of a group of children who are clinically diagnosed with ADHD. That can show us, by analysing the results of these children, whether these diagnoses are generally correct. We can also see, if there within the group of children with LD are cases without diagnosis, how the problems of diagnosis are reflected in the comparing analysis of the results of attention, working memory, etc. If we look at the two groups comparing the results, they are quite similar, which is why we consider the diagnosis to be correct. Even so, in the future it would be possible to adjust the group of children with LD a little, trying to find possible cases of ADHD, and then the differences might be bigger.

We also have to mention that even though the tests used to measure the aspects related to ADHD, such as attention and working memory, are many - with the results of a large

evaluation, it would not be entirely enough to do a diagnosis of ADHD. Some of the aspects, such as the sustained attention, would need other tests to be able to state a diagnosis, and for that purpose an individual evaluation would then have been more adequate.

Even so, our purpose was not to state a diagnosis but to simulate situations from school as much as possible. The evaluation and diagnosis have been put together by a professional that knows about the methods of investigation and testing to make a diagnosis, this is of great interest and applicability (Álvarez et al., 2007).

Finally, another purpose of this chapter is to know epidemiological data of our sample, since it is broad and has an important clinical support. In first place we wanted to know if the ratio male-female correspond to other international studies (Egger, Kondo, & Angold, 2006). The results correspond almost exactly, having a percentage of an 80.8 per cent male and 19.2 per cent female in the sample, which correspond to the ratio of four to one explained in other epidemiological studies.

Other interesting aspect (Willcutt & Pennington, 2000) has to do with the percentage of children suffering from ADHD who present LD in writing. Generally, a 59.59 per cent of the children suffering from ADHD suffer also from LD in writing in function of the criteria used, and the remaining 40.4 per cent have not LD in writing. Table 1 shows a summary of these epidemiological data.

	<b>ADHD with WLD</b>	<b>ADHD without LD</b>	<b>WLD</b>
<b>Male</b>	50/ 50,5%	30/ 30,30%	80/ 80,8
<b>Female</b>	9/ 9,09%	10/ 10,10%	19/ 19.19%
<b>Total</b>	59/ 59,59%	40/ 40,4%	Ratio male/female 4 a 1

ADHD: attention deficit and hyperactivity disorder (ADHD), WLD: writing Learning Disabilities

Table 1. Epidemiological data of the sample, total and percentage

Finally, all the theoretical revision and the empiric studies on ADHD do not answer the question if the relation between ADHD and learning disabilities in writing is possibly an overlap or link. It is a question that is yet not answered, and therefore, with this research, we hope to make progress in answering it, although not completely. We will later extend and reflect on the conclusions we have made on this topic but it is essential to stress that we can partly be satisfied with the results we have made regarding this, and with the partial achievement of our aim.

In short, the theoretical perspective of this chapter has served to let us know about the concept of ADHD, a concept that is under change and that is in need of empirical studies to narrow its current gap. Even so, we have gotten to know a theoretical model which has been of great use, and which we have also been able to apply to our study field. We have also given the disorder a psycho-educational approach, both in terms of diagnosis as well as intervention, agreeing with our aims.

On the other hand, we have focused and related ADHD with other of our main topics in our work, such as LD in writing. The epidemiological relations between both of the problems, and the theoretical relation, seem symptomatic. This conclusion has no empiric support, which creates a gap that we hope to fill with this chapter, even if it is only a little.

With all previously mentioned facts, we have covered partial conclusions. It has also served as an introduction to explaining the conclusions made from our empiric studies, and as will follow we will explain this in a reflexive way. These conclusions are based on the results in the field studies, and keeping in mind the theoretical conclusions we hope to have answers to our aims.

### **3. Three empirical studies about ADHD and writing**

The prevalence of the ADHD is high; between 3 and 6 per cent of all school age children present with it (Jakobson & Kikas, 2007). Other research studies have reported even higher percentages and state that up to 5 to 10 per cent of school age children have ADHD (Frazier, Youngstrom, Glutting, & Watkins, 2007). With these facts and considering the education system, it must be borne in mind that there is at least one child in each classroom that has a diagnosis of ADHD (Barkley, 2007). Considering the high prevalence and the large coincidence as well as the fact that people with ADHD show a lack of control of their impulses, it is probable that this will reflect in their written compositions and its learning disabilities.

Therefore, the need and relevance of furthering the research as regards the coincidence between ADHD and LD is evident. Given that few researchers have tried to identify the relationship between the various and frequently occurring subtypes that present in students with ADHD and writing learning disabilities, we aim to further the research in this area (Gregg et al., 2002). In addition, it would be important to discover whether if the link between ADHD and writing LD can be considered as relationship of comorbidity, and also whether the problems that this group presents are more serious than the sum of the problems related to working memory, attention and writing that each group presents separately.

In this chapter, the theoretical element attempts to focus the aims and hypothesis of the empirical research about ADHD and writing LD, and therefore includes the pertinent and immediate antecedents. We carried out a review of the empirical studies on ADHD and writing from recent years. The primary conclusions established the deficit of empirical studies related to writing and ADHD. To be more exact, the deficit is even more obvious when the written composition is considered in relation to the processes followed by ADHD students and the written products they construct. The only studies that have been carried out only face the problem in a superficial way, without entering in detail.

It is predictable that we can achieve some understanding about the problem that these people face by doing research into composition written, but we also need more specific and in-depth research studies. Furthermore, there is a lack of research, from an educational perspective, regarding the coincidence of ADHD and composition writing. At the same time, there are also theories that consider the relationship between writing and ADHD, and

this could lead to the creation of a specific model which accounts for both aspects, as a first step in future research (Rodríguez et al., 2009a; 2009b)

This research line exemplified in this chapter would be both important and relevant, as it is a study into ADHD and writing LD covering the various aspects which link these disorders using various research designs. In the first place, children with normal development (quasi-experimental study in attention and writing) are the subject. Secondly, ADHD children both with and without writing LD and without both problems, in attention, writing revision and working memory measurements (first comparative study) are the aim of investigation, and finally the attention is given to the writing product, processes and its orchestration (second comparative study).

### 3.1 Experimental study

First study aims to describe the role that attention plays in the writing process. The independent variables are subjected to different kinds of manipulation in the evaluation of written compositions. We investigated the effect of different psychological aspects related to ADHD in the main processes involved in composition writing. We also introduced aids, such as graphic organizers, in an attempt to understand its adaptability in the changing tasks of writing, and to show its merit when it comes to facilitating the textual planning and organization.

This study comprised a sample of 326 pupils, aged between 10 and 16 years old, in the 5<sup>th</sup> and 6<sup>th</sup> years of Primary School and in the 1<sup>st</sup> and 2<sup>nd</sup> years of Secondary School. We used a nest experimental design; we compared the two groups, one of which made use of the graphic organizer during the writing process. Each of these groups is divided in two, and evaluated using a register of time intervals, with an average interval of 45 seconds for one group and 90 seconds for the other one, marked by a beep sounded during the realization of the writing task. The pupils must register their activity in the process categories when the beep is heard.

All the participants completed two different writing tasks (argumentative and cause-effect) in order to assess the productivity, quality and structure, as well as the writing processes. A *writing log* which is a time-sampled self-report on-line technique was employed (modified double and triple task) (Olive, Kellogg, & Piolat, 2002; Torrance & Galbraith, 2006). Finally, we tested in the class groups the influence of variables related to ADHD (sustained and selective attention, ADHD symptoms, DSM-IV and working memory).

The results illustrate the negative effect of the interval register used during the use of writing log. It was found that a lower average provides greater information but, at the same time it distorts the task and the obtained results. This may be a result of the greater cognitive effort that the double task requires. We also studied the extent of the practical use of the graphic organizer during the writing tasks, and the consequent improvement in the compositions of the students using it. The results we had confirmed the achievement of the aim, but the most important results are that they indicate very interesting applications and future prospects, and of great applicability.

Finally, it is important to highlight that the positive influence of the planning and organization of the graphic organizer is superior to the distortion provoked by a lower

average in the codification of the processes. This leads to a discussion of the expectations of educational practice in this kind of aid, and what this might imply for future research projects, for example in students with ADHD (García & Rodríguez, 2007).

On the other hand, *writing log* or *the modification of the double and triple task* (García, Rodríguez, Pacheco, & Diez, 2009; Olive, Kellog, & Piolat, 2002) presents a great capacity of evaluation of the psychological processes involved in the written composition. It gives us information about the temporary organization of the students when they carry out a task of written composition, independently of which type of text they had to write.

This kind of evaluation-on-line- also gives us information about the written product, but the results we had on this area showed us that the data on the product are not as reliable as the ones on the process. And here we were presented to an important dichotomy. On the one hand we could make the students register the process of writing in their *writing log* (Figure 1) with a longer average of time, but the information we would obtain would be scarce. On the other hand we could reduce previously mentioned average time, but this study has showed us that that act seriously deforms the product in terms of productivity, coherence and quality, or even the process - even though this last thing is regarding quantity, not regarding the orchestration and temporary organization of the cognitive processes involved with written composition, which is not affected.

DEFINITIONS	ACTIONS	1	2	3	4	5
I'm reading the reference materials.	READING INFORMATION 					
I'm thinking of things to say in my text.	THINKING ABOUT CONTENT 					
I'm writing a plan of what you going to write in the text. From notes to detailed outline.	WRITING OUTLINE 					
I'm editing my definitive text. A neat or a dirty copy of text.	WRITING TEXT 					
I'm reading though all or part of my text.	READING TEXT 					
I'm making changes to my text (orthographic mistakes, changing words, adding words, etc.)	CHANGING TEXT 					
I'm doing or thinking something unrelated to the text (for example: talking to my partner, looking for a pen; looking through the window...)	UNRELATED 					

Fig. 1. Writing log and categories

The experiment carried out by reducing the interval of register within *the modification of the double and triple task* (Olive, Kellog, & Piolat, 2002) tells us that this test possesses great validity and credibility to measure the processes of written composition and to answer the question: *How* do students write? Even so, because of its nature - qualified as an *on-line* test - the evaluation of the textual product, or the answer to; *What* do students write?, does not

have the same validity or credibility. The results in that area are deformed, this deformation depending on the average interval that we use - which the students will use as their base to register their processes. We can solve this limitation in a very simple way. In first place, the students had to carry out *only* a task of written composition to know the textual product, and then later on we applied the writing log to the same type of text to get to know the process - and in that way have both results independently.

Everything we have seen so far seems to indicate that complex tasks, such as the written composition, demand a higher attention effort, something that does not occur with mechanical tasks. Therefore, if the task is not adapted to the complexity that a child who suffers from ADHD can manage, the failure seems unavoidable. From this result we see the need of schools and teachers to adapt the tasks when they have a situation which involves a child with ADHD, and it can also, in a way, explain why children with high intelligence and ability but who suffer from ADHD can end up failing in school. This theory has support from the other conclusion, which has to do with the emotional ingredient the child feels towards the task.

The results on attitudes and self-efficiency towards writing within the group that had the worst results in terms of productivity, coherence and quality - that is the group of 45 seconds - showed that they noticed this problem in their efficiency, and they also answered worse about their attitudes towards the task, being more negative. In short, we see that the emotional ingredient is also involved, even though it has to be mentioned that even if this study gives us these results, there would have to be more specific research necessary in terms of the emotional ingredient of ADHD and writing to settle on these terms.

Moreover, results show us something that has hardly been studied before, and that is the capacity of the graphic organizer to focus the attention and cognitive effort of the student in the task of written composition. In that way, it helps avoiding the interference and distortion that any situation can have; in our case it is the manipulated variable, and in the case of a real school hall situation it could be any of the natural variables that could distract the student, keeping them from focusing their limited attention (Rodríguez et al., 2011a; Shalev & Tsal, 2003) on the task of written composition.

In short, the capacity of the organizing graphic to focus the attention of the written composition is superior to the capacity of distorting the manipulated variable during the course of this task, which was evaluated by the means of writing log (Olive, Kellogg, & Piolat, 2002). If we go away to the everyday practise in education, one could consider the graphic organizer as a help, a scaffolding which might be offered to the student - and not only to any student but to those of which their attention capacity does not correspond to the complexity of the task, for example organization and planning. Its utility can also be seen in different kinds of texts, with a simple and plain design.

In fact, inter-relation between two hypotheses is what is most useful to us from the educational point of view, since the students had never practiced the use of the organizing graphic (Figure 2), and there was practically no knowledge at all about it, which brought as a consequence that its use was practically intuitive. The future action with this kind of help and the practice of for example the self-regulation, might be a link of union on how to intervention in ADHD and LD, as we have already seen in some previous concrete work, even if they have been with a number of limitations (Reid & Lienemann, 2006).

Graphic Organizer: argument text type

**Introduction:**

Subject: persuade somebody.....about.....  
 .....because

Real Situation:.....doesn't like that.....

**Arguments or reasons:**

<ol style="list-style-type: none"> <li>1. Firstly, _____</li> <li>2. Secondly, _____</li> <li>3. Moreover, _____</li> <li>4. Also, _____</li> <li>5. Nevertheless, _____</li> <li>6. On the one hand _____</li> <li>7. Likewise _____</li> <li>8. And the same to you, _____</li> <li>9. As well _____</li> <li>10. Finally, _____</li> </ol>	<p>example</p>	<p>_____</p>
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**Conclusion:**

In short, \_\_\_\_\_  
 \_\_\_\_\_, and I would like.....

Fig. 2. Graphic Organiser used in the argument text type

### 3.2 Second comparative study

The second study was a comparative design. The aim of this study was to compare the differences between children with ADHD both with and without writing LD and those with writing LD, in the measurements of different constructs related to ADHD (selective and sustained attention, working memory and cognitive styles). Furthermore we aimed to

compare, the differences between the groups as regards the revision of writing. Finally, we studied the influence of the first measurement in the revision task.

For this study we used a sample of students with ADHD, these students represented practically the whole range of school years except for the first year of Primary School. These children were later separated into the different categories of students; those with ADHD *as well as* learning and writing disabilities, and those students suffering from ADHD *without* these disabilities. In addition to these two categories a third and a fourth group were added; students with LD in writing only, and also a control group of normally achieving students. Our sample comprised 339 students from 3<sup>rd</sup> year of Primary school to 4<sup>th</sup> year of Secondary School and consisted of four groups: 59 students diagnosed with ADHD and LD, 40 with ADHD without LD, 115 with LD and/or low achievement (LA), and 124 normally achieving students formed the control group. All of the students ranged between eight and sixteen years old. In total, we had four different, independent groups, matched in age and educational level.

The results were observed independently between the groups in all the previously mentioned aspects, as well as the effect on the statistics of the first tests, for example results of the IQ evaluation, attention, working memory, and the re-writing tests.

When we thought of and planned the tasks of re-writing, the way and form of presenting it influenced our thoughts. In open tasks, in which there are other stimulations such as a description, the groups of children suffering from ADHD and LD in writing hardly add any information, which has a negative effect on their final product – they just limit their work to copying. There are smaller differences when it comes to more narrow tasks. That is, the more we set the standard and the more we focus the process of revision, the more the children suffering from ADHD and LD in writing benefit from it. It is also interesting to see that the differences and problems of children suffering from ADHD are found mostly within the fundamental revision, more than in the mechanical revision or automatic processes. An interesting opinion comes up when we focus on the added information of the different groups; the stimulation of the creativity between the children suffering from ADHD makes them add information. This may indicate that the capacity of the ADHD is reflected in the revision. The relation between ADHD and the revision of writing have been used as measurements to investigate the intervention in writing between these kinds of students. It was an opportunity to find out how this task is related to ADHD. In our study, all constructs related with ADHD influenced the measurements of re-writing, but the most important one they influenced was the executive one (working memory and attention), which without doubt is directly related to ADHD and its problems of revision of written material.

In conclusion, lower results were found in children suffering from ADHD and learning disabilities as regards the attention and memory evaluation. These results also reflect in the results of the re-writing task, which might suggest a link between the two disorders. Considering these results, we conclude by making a few remarks on the difficulty of the tasks and its effects on ADHD, and predictions for this group in the revision tasks as regards the inclusion of a greater or lesser amount of detail. Moreover, we suggest the possible influence of the psychological construct difficulties in ADHD and LD (attention, working memory), in the revision task and its importance in training programs, to improve writing in children with ADHD.

### 3.3 Third comparative study

The last study is also a comparative study, which was intended to complement the previous study, as it has the same sample and design. It clearly explains the nature of the written compositions in the four groups, and how ADHD and learning disabilities affect this writing; both in the productivity and quality of their writing. Furthermore, as the most innovative aspect, it details the time distribution used in the orchestration of writing process.

All the participants completed three different writing composition tasks (free topic, compare-contrast essay and revision), to assess the productivity, quality and structure; as well as writing processes using a time-sampled self-report on-line technique registered on a writing log. Finally, three questionnaires which dealt with the attitudes and self-efficacy towards writing were completed. We also kept in mind the different attention and working memory measurements that the students provided (previous study).

Furthermore, even though it is important to be aware of the final texts that the students produce, this research emphasizes the writing processes rather than the result –the product. Thus, it is possible to understand how students with ADHD and learning disabilities write. Finally, we established the connection between the processes of writing and the final product –quality and productivity-. With these previous facts it is possible to establish an instructional and psycho-educative baseline to attend to the writing disabilities of these children and their different problems. The results showed the influence of ADHD in writing, for example as concerns sustained attention combined with working memory.

Finally, it is important to stress, the important differences in writing time distribution (orchestration) between the groups which would need to be considered in the different instructional programs. Children with ADHD and LD spend much less time on processes such as thinking about the text, reading the text or correcting the text and their resulting compositions reflect this in the inferior levels of coherence and quality. This signals an inadequate use of the planning and revision processes, which is directly related to the lesser quality of their texts. It is important to highlight that such processes must be used adequately along with a logical use of orchestration. However, this is not demonstrated by children with ADHD or LD. This is compared with previous study which concluded that the students carried out the rewriting task in a less than efficient manner.

The educative implications to achieve improvement in the planning and revising, changing the orchestration process in the composition writing of children with ADHD and LD are evident.

## 4. Conclusion

The conclusions support the idea of a significant relationship between ADHD and writing, on one hand, on a theoretical level, and on the other hand, on a research level. We suggest that the influence of ADHD in school achievement is one of the most important disorders associated with LD in writing. We can also see that these links are not backed up by scientific empirical studies in these aspects. We found that the scientific research about the link between ADHD and writing was generally limited to the mechanical aspects of this skill, textual production skills-, or simple aspects such as the handwriting. On the few

occasions that more comprehensive studies were done, the samples were not broad enough, or they are based on epidemiological studies or used a questionnaire to define the child with ADHD. It could be said that generally, the underlying processes of ADHD are not sufficiently analyzed or studied deeply enough, for example as regards to the orchestration of writing process, but rather they have been only studied in a general way.

The experimental study revealed aspects that have scarcely been studied before, such as the capacity of the graphic organizer to help focus the attention and cognitive effort of the student in the composition writing task. It helps by avoiding the interference and distortion that any situation can have. In our case, the interference took the form of the modification of the double and triple task *-writing log-*, and in the case of a real classroom situation the interference could be any of the natural variables that could distract the student, preventing them from focusing their limited attention on the writing task. Furthermore, the relationship between sustained attention and writing was demonstrated, showing that the writing processes which require the child's capacity to be constant until they finish the writing task. The study also introduces us to the concept named *sluggish cognitive tempo*, which is seen in the inattentive subtype of ADHD and which is the most likely to demonstrate writing LD (Graham & Harris, 2005).

On the other hand, the outline of the poor results for revision in the ADHD and LD group concurs with the obtained outline in the measurements of attention, working memory and cognitive types. This idea supports the possibility that both these syndromes might have an effect on each other. The group of children with ADHD presents a profile indicating a link between the two syndromes – which is also shown in the re-writing task. This relationship suggests that the revision writing process may provide an area of research for the study of intervention in writing between these kinds of students.

We also consider that the research has been profound enough; we have worked with the problems of carrying out these tasks in children with ADHD, their predisposition to carry out writing tasks, as well as including the emotional aspects of the problem. It is clear that that it is possible to develop a higher quality of written composition by improving the cognitive process as well as its organization. Even so, these aspects do not only depend on the child with ADHD, who we know to possess the capacity. The aspects are also concerned with the ability to adapt to the problem in terms of the complexity of the tasks, or the provided strategies. Therefore, these results widen our awareness of the problem, and stress the importance of the need to consider the way our students write.

Moreover, influence of neuropsychological factors such as the working memory and attention, are the least studied ones within the process of writing. The characteristics presented by experts and bad writers, show us the strong influence of the neuropsychological functions on the quality and carrying out of the writing, as well as the direct influence on the processes of writing (Hooper, Swartz, Wakely, De Kruif, & Montgomery, 2002).

At this point, there is specifically one neuropsychological construct which is more affected among the children suffering from ADHD; that is working memory. The hypothesis was to put this type of memory in relation to the measurements of writings that we have carried out. It is true that the size of this effect was moderate, but the influence of the factor of the working memory creates a radical change in the meaning of the variables of writing, which

gives us a hint to a relation between ADHD and written composition. Within this relation it seems as if the average of the processes is what is most important, and is what the process of written composition demands of the child's capacity to remain until the achievement of finalizing the writing task. It also introduces us to the approximation to the concept *sluggish cognitive tempo*, as the one where the subtype inattentive is developed and which is the most probable to express LD (Aaron, Joshi, Palmer, Smith, & Kirby, 2002).

According to recent research, we previously mentioned the executive central, and based on that we could say that there is an increasing relation between working memory and attention when it comes to carrying out of a task. So, the influence of the measurements of the working memory and the measurements of the writing process and product seem to coincide with each other, an area which should be stressed in future research, give us a total of the measurements in terms of carrying out a task – and then contrast this effect with the measurements of written composition.

In short, complexity of written composition is proven by the influence of several neuropsychological factors, which makes this a complex task. Also, these factors should be studied profoundly, as for example the ones used in this research; attention, working memory and indicators of ADHD - opening up for research on the intervention in writing and propounding the use of these factors in the instruction. Finally, ADHD is a disorder which has often other problems added, such as LD in writing. We wanted to verify this relation through the influence of the criteria DSM-IV on ADHD, under the perspective of the teacher, in the measurements of written composition with hopeful results. Parameters such as coherence, productivity and structure are affected, indicating that the influence is not merely a simple theoretical approximation but that the two concepts of ADHD and written composition are really close to each other; we only need to quantify and put limitations to this relation.

Therefore, in the future, the scientific community should pay attention to the writing problems those children with ADHD experience. Moreover, a theoretical model which accounts for the problems of both syndromes may be necessary. This could also provide the key to possible writing instructional programs that would respond to the needs of this kind of student with ADHD and LD, all from a psycho-educational point of view. Finally it is very important to emphasize the idea of co-morbidity between ADHD and writing LD, and consider a writing cognitive design, specifically for the children with both disorders. This group presented greater difficulties in the measures of attention, working memory and writing, than if we consider the sum of the separate problems experienced by the ADHD group and writing LD group. Thus, for this joint group the difficulties are not simply added rather they interact to the detriment of the child in a similar way as occurs for other subjects such math or reading (Rodriguez et al., 2009c).

Many researches study the links of ADHD through large bases of data (Smith & Adams, 2006), but there are few ones that are done through the practice, where samples of children that have been diagnosed are studied – describing and analyzing profoundly their problems. We also know, through the empiric research on the subject that very few of these studies are concerned with the link or overlap between ADHD and written composition. In this chapter, we aim to fill some of the existing gaps with the conclusions we have drawn.

Another aspect to stress in our research are the measurements that make the most difference, which each has a certain power to make a difference – attention and working memory – to what we call the executive. The measurements of attention (in ADHD) might be influenced by other fields, other measurements and/or other psychological aspects as for example working memory, force level etc. (Shalev & Tsal, 2000). The term “executive function” may be more interesting if aspects such as the working memory, the executive attention, the active attention, planning or inhibiting control were included.

In that way, we have to emphasize the use of different measurements to achieve one single construct, which we have extracted from different fields of investigation such as the attention factor. This is a positive result to which we should apply the diagnosis of ADHD. This might be a complex disorder situated in a context in need of contrasting evidence, and that these cover a large range to get to know the difficulties of a child suffering from ADHD.

Following the line of diagnosis, one could hope that there were no significant differences in terms of the IQ of children suffering from ADHD (Breznitz, 2003; Hastings, Beck, Daley, & Hill, 2005; Schuck & Crinella, 2005). We can in this study confirm the results of those empiric studies, stating that the differences in terms of IQ of the group with children suffering from ADHD are not significant, showing that the problems of these children do not base in their capacity, but in the ability to perform the task (Rodriguez et al., 2009a).

As regards the shortcomings of this study, it would be interesting to investigate the assessment of the executive and brain activation in ADHD and LD, or to demonstrate the differences in the writing of the various ADHD subtypes (inattentive, combined, etc.). Finally, the future perspectives indicate that this study is a relevant step towards understanding the writing disabilities in ADHD students. However, it is necessary to establish a common basic model which explains the learning difficulties that children with ADHD experience and those which concerning writing (Gonzalez-Castro et al., 2010; Rodriguez et al., 2009b).

## 5. Acknowledgment

I acknowledge and thank Stina Gustafson and Urbano Alvarez for her generous cooperation in translating this chapter into English.

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## **Learning Disabilities**

Edited by Dr. Wichian Sittiprapaporn

ISBN 978-953-51-0269-4

Hard cover, 364 pages

**Publisher** InTech

**Published online** 14, March, 2012

**Published in print edition** March, 2012

Learning disability is a classification that includes several disorders in which a person has difficulty learning in a typical manner. Depending on the type and severity of the disability, interventions may be used to help the individual learn strategies that will foster future success. Some interventions can be quite simplistic, while others are intricate and complex. This book deserves a wide audience; it will be beneficial not only for teachers and parents struggling with attachment or behavior issues, but it will also benefit health care professionals and therapists working directly with special needs such as sensory integration dysfunction.

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Celestino Rodríguez, Paloma González-Castro, Rebeca Cerezo and David Álvarez (2012). Attention Deficit Hyperactivity Disorder (ADHD) and Writing Learning Disabilities, Learning Disabilities, Dr. Wichian Sittiprapaporn (Ed.), ISBN: 978-953-51-0269-4, InTech, Available from:  
<http://www.intechopen.com/books/learning-disabilities/attention-deficit-hyperactivity-disorder-adhd-and-writing-learning-disabilities>

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